

Historical Atlas of the Low Countries: A GIS Dataset of Locality-Level Boundaries (1350–1800)

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Abstract

This historical GIS provides reconstructions of premodern village-level boundaries in the Low Countries, covering the present-day Netherlands, Belgium, Luxembourg and adjacent parts of France and Germany. While some countries have historical municipal GIS maps for the nineteenth and twentieth centuries, this resource provides a detailed and contiguous historical GIS for the premodern period. It also covers an area spanning several modern states, a rare undertaking. It combines modern and historical sources, including existing GIS data, historical maps, and written records, focusing on the ‘smallest mappable units’ referred to as administrative areas in contemporary documents, such as parishes, lordships, or towns. This article accompanies the first tranche of the dataset for the 1500 cross-section, which can be used to link statistics for any period between 1350 and 1800. When completed, the GIS dataset will cover four cross-sections: 1350, 1500, 1650, and 1800. Each cross-section will comprise an estimated 18,000 geographical units – typically around 5 to 10 km² each. The dataset facilitates cross-temporal analysis of historical statistics while allowing users to consider the wider geographical and territorial micro and macro context of these statistics. The result will be an invaluable resource for historians, archaeologists, geographers, and social scientists alike.

Keywords

geohumanities – spatial humanities – historical GIS – village-level boundaries – Middle Ages – Early Modern – Netherlands – Belgium

- Related data set “Historical Atlas of the Low Countries (1350–1800)” with Handle <https://hdl.handle.net/10622/PGFYTM> in repository “IISH Data Collection”

1 Introduction

One hundred years have passed since the first volume of the *Geschiedkundige Atlas van Nederland* (Historical Atlas of the Netherlands) was published under the direction of Petrus Blok and Anton Beekman. It comprised over thirty descriptive volumes and many maps of the Netherlands and its colonies, from Roman times to the nineteenth century. With the advent of the computer, however, techniques for creating and analysing maps have developed rapidly and are increasingly attracting the interest of humanities scholars. Unlike printed maps, digital GIS maps allow users to combine and analyse different maps or layers of information easily. Although this has led to many important projects in the spatial humanities, – for the Netherlands and Belgium perhaps most notably the *HISGIS Belgium*, *NLGis*, and *HisGIS Netherlands* projects which aimed to produce time-sensitive municipal boundaries for 1800 (Belgium)¹ and 1812 onwards (Netherlands)², and a vectorised national atlas of parcels using early nineteenth-century cadastral maps respectively³ – the maps by the geographer and cartographer Beekman (with all the limitations of analogue maps) are still the main source for historical boundaries in the Netherlands (Commissie voor den Geschiedkundigen Atlas van Nederland, 1913–1938).

The lack of easily accessible and usable information on the territorial extent of premodern localities and societies is a critical omission for anyone interested in this period. Any longitudinal analysis of historical statistics falls short if changing geographical units are not taken into account. This can be illustrated by a simple example. The freedom and later municipality of Amsterdam grew from a mere 1.1 km² at the beginning of the fifteenth century to no less than 165 km² today. Ignoring the effects of this territorial expansion leads to misleading conclusions about urban development or long-term population growth in the city. It is by no means straightforward to overcome these problems, given the mutable nature of both modern and premodern boundaries in the Low Countries. However, traditional resources in a historian's toolkit, such as the

1 No longer available online but maintained by the Quetelet Center of Ghent University as part of the *LOKSTAT* project: www.queteletcenter.ugent.be.

2 www.nlgis.nl.

3 www.hisgis.nl.

printed maps of Beekman's atlas, provide a fixed snapshot in time for a problem that requires a more flexible solution and more analytical instruments. To address this, a digital GIS dataset of the historical boundaries of cities, parishes, *heerlijkheden* (lordships), and other meaningful administrative-judicial or (sometimes overlapping) religious entities in the medieval and early modern Low Countries has been created to facilitate cross-temporal comparisons.

Unlike Beekman's maps (Commissie voor den Geschiedkundigen Atlas van Nederland, 1913–1938), which were largely confined to the Dutch national borders, this new set of GIS maps has a much wider geographical scope, covering the entire Low Countries and more than fifty territories. Although there has never been a formal definition of what constitutes these Low Countries in geographical, political, economic, cultural, linguistic, or any other terms, the idea of the Low Countries resonated – and still resonates – with the public.⁴ The idea of a series of territories near the estuaries of the Rhine, Meuse, and Scheldt that were both distinct from their neighbours (France and the adjoining parts of the Holy Roman Empire) in some way and shared some common ground is a fairly consistent one from the Middle Ages onwards – even if the fluid characterisation of the Low Countries regularly confused contemporaries too (Duke, 2004). Here, the Low Countries are loosely defined as the former territories that are (partly) covered by the present-day states of the Netherlands, Belgium, and Luxembourg, or neighbouring territories that came under Burgundian-Habsburg influence from the fourteenth century onwards. These include for instance Picardy (briefly subject to Burgundy between 1435 and 1477) or Cleves and Jülich (parts of which were in what is now the Netherlands). Although the dataset can be expanded to include other premodern territories in Europe, whether or not they border the Low Countries – there are no plans to do so at present.

This article focuses on the rationale behind the project and its database structure. It accompanies the publication of a new and substantial tranche of the dataset, which functions as a complete historical GIS dataset. This tranche covers all the core territories of the Low Countries (over 16,000 geographical units) for the first cross-section 1500 – of four projected cross-sections in total (1350, 1650, 1800). Not yet included in this tranche are a handful of partially

4 The term is strongly ingrained in scholarly practice, as reflected by the wide array of scientific journals referring to the 'Low Countries' in their title: *The Medieval Low Countries*, *Early Modern Low Countries*, *TSEG – The Low Countries Journal of Social and Economic History*, *BMGN – Low Countries Historical Review*, *Dutch Crossing – Journal of Low Countries Studies*, *Journal of Archaeology in the Low Countries*, *Politics of the Low Countries*, *Oud Holland – Journal for Art of the Low Countries*.

processed adjacent territories in Westphalia and the Rhineland (see Figure 1). These territories, as well as the three remaining cross-sections, will be incorporated in stages (see Appendix, Table A1). When completed, each cross-section will comprise of an estimated 18.000 geographical units – typically around 5 to 10 km² each.

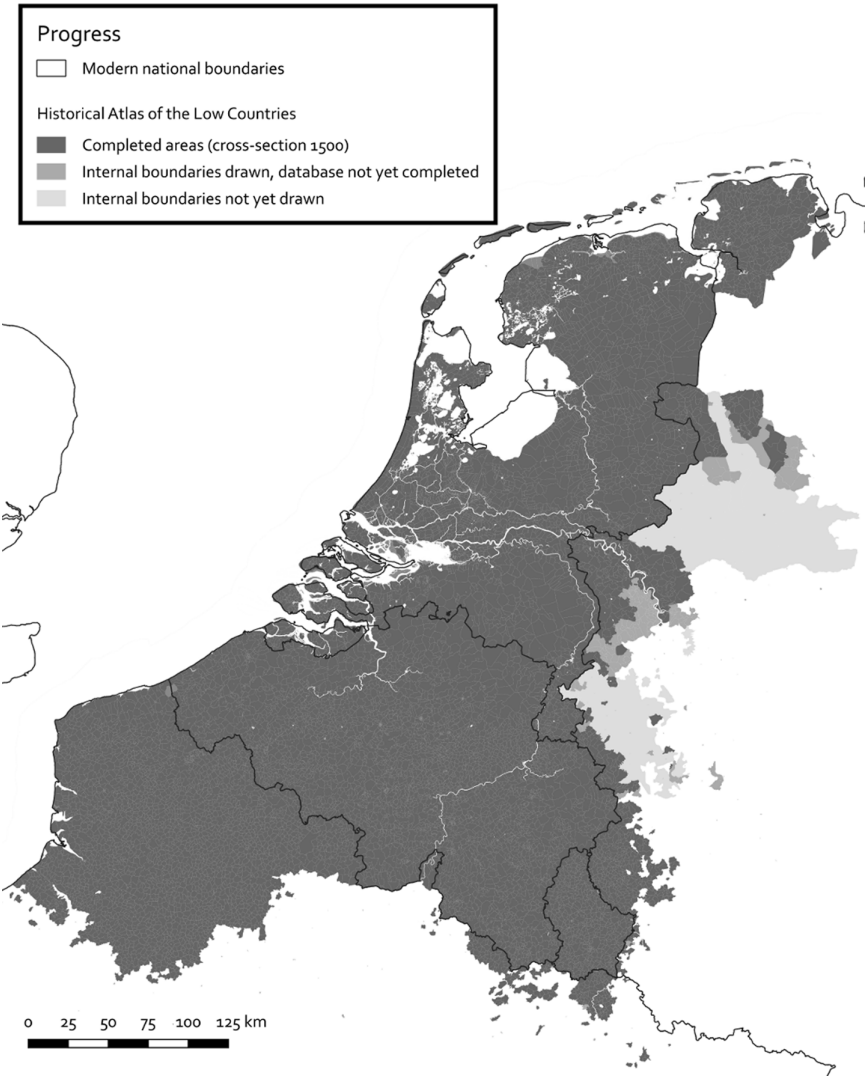


FIGURE 1 Current state of the database construction (situation autumn 2023)

2 Related Research

While there are tentative plans to create a single GIS dataset of local historical boundaries for the whole of Europe,⁵ there are few existing historical GIS projects of this detail and scope, particularly for the premodern period. Despite this limited availability, the earliest efforts to create historical GIS datasets can be traced back decades, including for the area of our focus. These efforts mainly cover the period from the nineteenth century onwards and focus on the production of digitised historical boundaries for municipalities or comparable administrative units. Examples include the *NLGis* (1812-present) and *HISGIS Belgium* (1800-present) projects mentioned above, as well as the *NHGIS* for the United States (1850-present)⁶ or *Great Britain Historical GIS* (1801-present).⁷ Relevant for the Low Countries but conspicuously absent are France (for which significant progress is being made through the *ANR Communes* project that started work in 2020⁸), Luxembourg, and Germany.⁹

For the pre-modern period, examples are much rarer. For Portugal, although apparently no longer maintained, parish and other boundaries from the mid-eighteenth century are available through the *Atlas Cartografia Histórica*.¹⁰ The *Down Survey of Ireland* project has produced a GIS dataset based on the modern boundaries of Ireland's smallest administrative unit, townlands, linked to seventeenth-century censuses.¹¹ Both are accessible only via a web interface. The ongoing *Atlas Fontium* project, which focuses on premodern Poland, also includes some parish-level boundaries. However, the emphasis is on gazetteers (descriptions of place names) and less granular level boundaries.¹² Outside Europe, comparable projects have been set up in China (*China Historical GIS*¹³) and colonial Spanish America (*HGIS de las Indias*¹⁴). For Russia, *governorate*-level boundaries are available for 1897 (Kessler, 2017).

5 www.campop.geog.cam.ac.uk/research/projects/internationaloccupations/enchpogpos.

6 www.nhgis.org.

7 www.visionofbritain.org.uk.

8 <https://anrcommunes.hypotheses.org>. French departmental GIS boundaries for 1790 are available at <https://dataverse.harvard.edu/dataverse/french-historical-gis>, whereas GIS data for 1870–1940 can be found at <https://dataverse.harvard.edu/dataverse/TRF-GIS>. Both do not offer parish-equivalent level boundaries.

9 For Germany, the *HGIS Germany* project captures only district-, province- and state-level boundaries between 1820 and 1914: www.hgisg-ekompendium.ieg-mainz.de. Access to the data is currently only secured via the Harvard Geospatial Library: <http://hgl.harvard.edu>.

10 <http://atlas.fcsh.unl.pt>.

11 <http://downsurvey.tcd.ie>.

12 www.atlasfontium.pl/language/en.

13 <http://sites.fas.harvard.edu/~chgis>.

14 www.hgis-indias.net and <https://dataverse.harvard.edu/dataverse/hgis-indias>.

Several of the above examples, like many early historical GIS projects, had a strong technical focus or quantitative, social science research objectives. It is striking that after a burst of new projects in the 1990s and early 21st century (Gregory & Healey, 2007; Knowles, 2005), interest in such ‘traditional’ forms of historical GIS seems to have slowed down, branching out into new disciplines such as *deep mapping* (Bodenhammer, 2018) and *thick mapping* (Presner et al., 2014), or being subsumed into broader fields such as *spatial history* or *spatial humanities* (Gregory & Geddes 2014). The maintenance of projects that originated in the pioneering years of historical GIS was not always assured. Often, projects depended on bespoke web applications, with little provision made to secure the underlying data (for numerous examples, now discontinued: Reports on national historical GIS projects, 2005). Perhaps the early enthusiasm for GIS projects that sought to intervene in long-standing scholarly debates ran up against practical difficulties. Such practicalities may have included the substantial investment in infrastructure required before any analysis could be undertaken, the lack of qualified scholars being able to bridge geoscience and humanities research, and fledgling analytical tools that could not yet meet ambitious scholarly goals, either because they were still in their infancy or because they were too complex for practical day-to-day use. Without analytical uses, historical GIS runs the risk of becoming a tool for visualisation.

Today, GIS is increasingly capable of handling not only quantitative but also heterogeneous, qualitative material; geospatial modelling is becoming more advanced; it has become easier to store GIS data in a sustainable manner and to ensure access to them; and, most importantly, access to training and tools has improved dramatically through open-source software packages and plugins. All in all, combined humanities and geosciences research has become a broad and mature field (Murrieta-Flores & Martins, 2019). Within this expanded field, now supported by greater access to rapidly advancing technology, there are also signs of a revival of ‘traditional’ historical GIS infrastructure projects that bridge the social sciences and humanities (see, e.g., footnote 5). The *Historical Atlas of the Low Countries* project is representative of this development.

3 Discussion of the Research Problem

The GIS dataset presented in this article addresses five key challenges. The first two are more methodological in nature and relate to the challenges of creating

a historical GIS for the premodern world, the other three highlight the need for historical GIS datasets of local boundaries. The latter three can all be traced back to vaguely defined or missing spatial dimensions of historical data.

- *Polygons and the deception of contiguity.* Almost all of the historical GIS projects listed above use polygons as their defining type of geometry. Polygon geometries can be used to construct a contiguous topological space in which every square metre is associated with a geographic entity defined in the dataset. This approach provides a powerful mode of visual communication and is useful for societies where the delineation and contiguity of spatial units – municipalities, for example – have a formal and legal basis. However, it has serious problems for many premodern societies, which involve complex and dynamic personal and communal constructions of space (Hardy, 2022; Zenobi, 2022). Polygon-based maps suggest a level of territoriality that clashes with reality (Scholz, 2019, pp. 212–213). In the Duchy of Luxembourg, for example, more than ten percent of the localities in our dataset are made up of households that owe allegiance to a different lord than the neighbouring households in that locality – a figure that rises significantly when aggregated to the level of parishes (for numerous examples: Petit, 2013, Vol. 3).

A concrete alternative is offered by point-based maps and related network models (Berman, 2005; Scholz, 2019). However, point-based maps also have limitations, especially when these points represent spatially more complex entities. It is difficult to identify and visualise missing values and observations, as there is no spatial constraint on the area in which a collection of points is positioned. This also affects the ability to perform simple calculations (such as densities) and to compare the data with area-based geographic information layers (such as palaeogeographic maps). The question is whether it is possible to combine the best of both worlds.

- *Reconstructing past local boundaries.* A second challenge is how to reconstruct past boundaries for historical societies for which (topographic) maps are lacking. It is well known that the boundaries of sovereign territories can shift dramatically over time and the Low Countries are no exception. This can be easily illustrated by examining the relationship of one locality to several sovereign territories: the strategic border town of Heusden in the Netherlands. The origins of the town can be traced back to the counts of Cleves. Sometime during the thirteenth or early fourteenth century the town became part of the Duchy of Brabant. In the meantime, the count of Holland also had his eye on the town and the surrounding countryside, and

in 1357 Heusden was formally transferred to Holland (a decision that was contested by Brabant in following decades). As such it also became part of the Dutch Republic. Holland and Heusden are then incorporated into the Batavian Republic in 1795, the Kingdom of Holland in 1806, the French Empire in 1810, and the Kingdom of the Netherlands in 1815. In the same year, Heusden is transferred from the province of Holland to the province of North-Brabant, to which it still belongs (Hoppenbrouwers, 1992, pp. 3–11). While the town remained in place, the territorial constellations changed quite dramatically under the pressure of war, political and dynastic events, or colonisation.

The case of Heusden is also important for a different reason. During a period of relative calm, in the early fourteenth century, the duke of Brabant and count of Holland were seeking to consolidate and specify their boundaries. This resulted in a series of formal agreements on local boundaries, called ‘paalscheidingen’ (demarcations by poles) (Hoppenbrouwers 1992, pp. 5 and 18–19). The modern Dutch verb ‘bepalen’ (to determine, to decide) literally refers to this act of putting poles in the ground (*Bepalen*, 2007). The period in which these boundaries were crystallised is consistent with similar evidence elsewhere in the Low Countries and generally predates the time period covered by this GIS dataset (Dury 2013; Pijnacker Hordijk, 1909, p. 209; Raue 1982, pp. 81–82, 89, and 249; van der Linden, 1956/1980, pp. 122 and 214). This, in turn, is consistent with broader chronological trends in local territorialisation in Western Europe (Baron et al., 2016; Zenobi, 2022).

Once such local boundaries of a parish, lordship, or municipality are established, they tend to follow a different logic from those of sovereign territories. If we ignore mergers, splits, and land reclamations, local boundaries are much more likely to remain stable over time (Bonenfant, 1953). There are local institutional pressures to maintain them: households in a locality cannot choose which parish or lordship they belong to, and uncertainty in this respect is undesirable for local religious or secular rulers. The establishment – and maintenance – of local boundaries therefore serves a purpose for the local community, not just for a higher sovereign with whom the locality is associated.

From the perspective of creating a historical GIS dataset of premodern boundaries, this means that it is tenable to use modern (19th to 21st century) local boundaries as a backbone for reconstructions of (much) earlier periods for which appropriate cartographic material is lacking or scarce. That is, as long as we find a way to deal effectively with a long and often unclear list of mergers and splits between local communities (for the role of mergers and

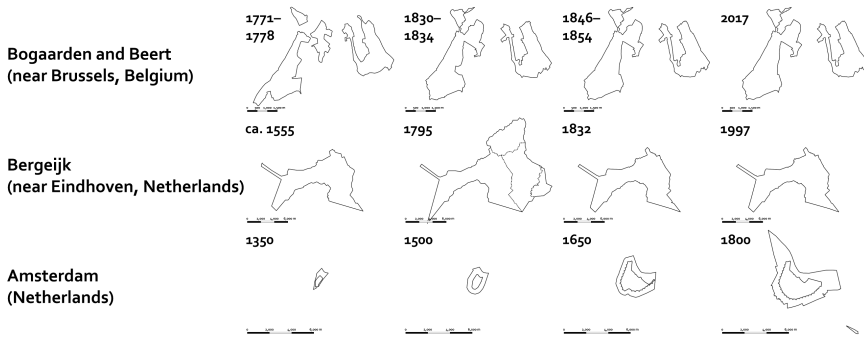


FIGURE 2 Continuity and change in the boundaries of a selection of localities, from top to bottom: Bogaarden and Beert (near Brussels), Bergeijk (near Eindhoven), and Amsterdam

SEE APPENDIX, TABLE A2

splits in a French context: Gay, 2021). In Section 4 on Methods, our approach to this problem using the example of Schipluiden near Delft is explained in more detail. This does not mean that local boundaries cannot change at all. Small, convenient border corrections often occur (compare, for example, the Brabantine villages of Bogaarden and Beert in Figure 2). For the north-western part of the Duchy of Luxembourg, such border corrections are well documented and visualised, showing that these corrections hardly change the total area sizes of the communities concerned (Mirguet, 1983, p. 27). The boundaries of urban centres can be an exception. Expanding towns often encroach on the surrounding countryside, pushing out both the secular and religious jurisdictions of the neighbouring villages. The city of Amsterdam is a prime example of this development (see Figure 2).

- *Linking (GIS) data layers.* Now we turn our attention to more conceptual challenges. The initial driver for the creation of this GIS atlas was to create the ability to link different datasets (called layers in GIS) via pre-defined locations. For example, a layer of population data could be linked to a layer of schools to produce meaningful regional maps of potential pupils per school. Calibrating covid infection levels in wastewater measurements to the number of connected households, using sewer network maps, is another example. The ability to do this is one of the key features of GIS software. However, the lack of period-specific geographic definitions of administrative-judicial units at the village level prevents the creation of links between historical statistics collected at this level and geographic data layers on land use, vegetation, transport networks, or digital elevation models. The combination of such layers opens up a wide range of new possibilities for spatial modelling.

- *The landscape as variable.* The layers described above are not only useful for spatial modelling. They are also essential for effectively incorporating the landscape and ecology into historical research. A dataset of coin finds takes on a whole new dimension when juxtaposed with a dataset describing the characteristics of the historical terrain in which the coin was once deposited. Only in this way can informed conclusions be drawn about the context of archaeological finds. Here, GIS is not so much an analytical tool as a tool that encourages humanities scholars to think about space and place and to formulate new research questions (Gregory & Geddes, 2014).
- *Comparative and longitudinal research.* It is difficult to conduct effective comparative research across time or between regions if the spatial dimensions are not properly defined. This problem is exacerbated when quantitative data are at the heart of the comparisons. Suppose you have two layers of similar data, one in 1500 and one in 1800, and you want to use them to calculate regional differences in growth. To do this effectively, the geographical extent of the two layers must be identical. However, it is very rare to find clear definitions of the geographical units to which a particular historical statistic applies (and which areas are not covered by it). More commonly such statistics are aggregated and/or extrapolated to regions loosely defined in terms such as ‘South Holland’, ‘Picardy’, or ‘around Liège’, or attempting to resemble modern national (or other administrative) boundaries. Such descriptions may be sufficient for more qualitative narratives, but are of limited value or even risk in quantitative or longitudinal research. Understanding the extent of this risk is a key aim of a replication study we are conducting, funded by the Dutch Research Council (NWO), the first results of which will be available soon.¹⁵

There are, of course, workarounds, some of which have been used for a long time. Paul Klep, in his 1981 study of the labour structure and demography of early modern Brabant, carefully aggregated his data until they more or less fitted the nineteenth-century municipal boundaries – for example, in order to present his data on maps. Joseph Cuvelier (1912) used essentially the same solution by creating a single table from several hearth counts of medieval Brabant and census data from 1900.

A common – but also potentially very problematic – workaround is to link statistics by the name given in the source. Consider various fiscal sources and population counts relating to the village of Schipluiden near Delft (see Figure 3). In 1840, the ‘municipality’ (*gemeente*) of Schipluiden counted

¹⁵ (Re)counting the Uncounted. Replication and Contextualisation of Dutch and Belgian Premodern Population Estimates (1350–1800). www.nwo.nl/en/projects/4019038.

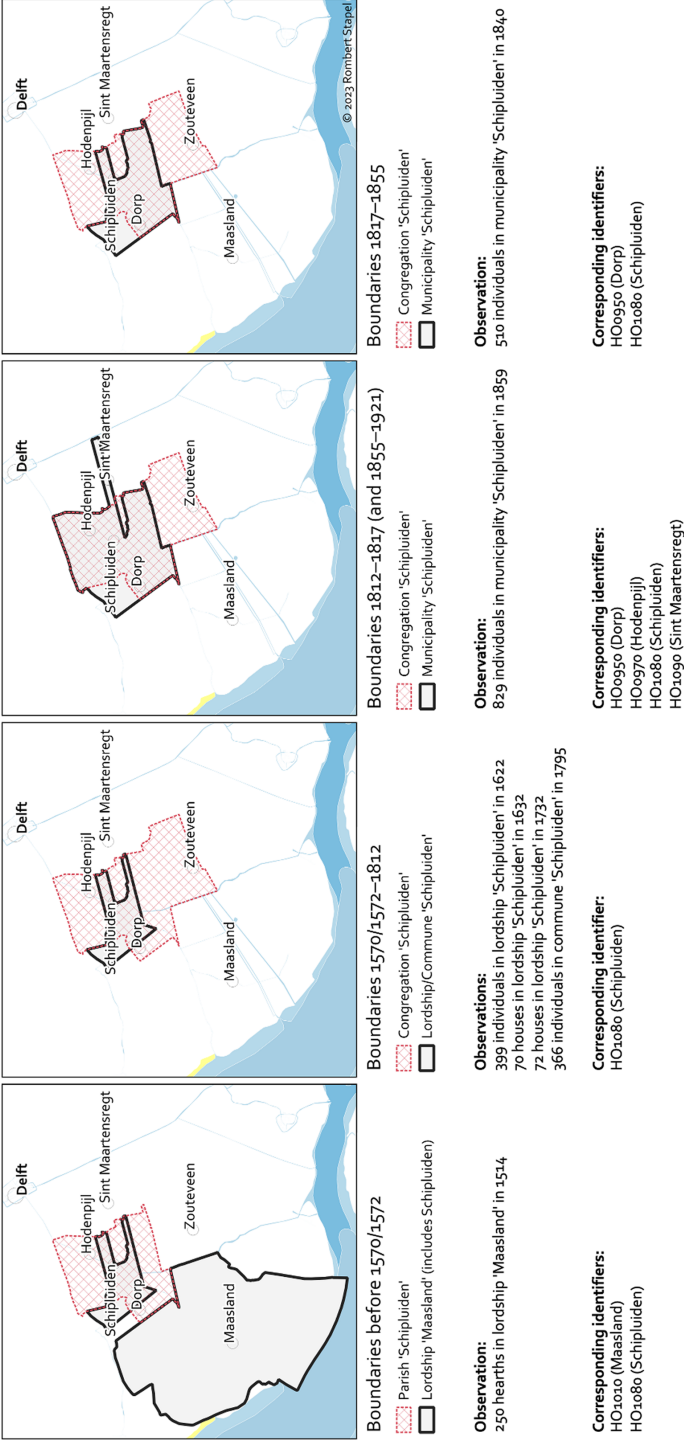


FIGURE 3 Historical statistics relating to Schipluiden, a village near Delft

510 individuals and 80 houses. In 1795, the ‘commune’ (*municipaliteit*) of Schipluiden – which matched the pre-1795 boundaries of the ‘lordship’ (*ambacht*) of Schipluiden – counted 366 individuals, which probably corresponds to approximately 55–60 houses (Meroño-Peñuela et al., 2017). However, we know from other sources, that the area of the municipality in 1840 was almost twice as large as that of the lordship before 1795, and that in 1840 it included the neighbouring polder (and former lordship) of Dorp. In 1632 and 1732 there were 70 and 72 houses respectively in Schipluiden (Burger van Schoorel 1767, p. 141; Tirion 1746, p. 549), while in 1622 there were 399 individuals living there (van Dillen, 1940, p. 174). Further back in time, in 1514, Schipluiden is counted together with neighbouring Maasland. Collectively, the villages had 250 ‘hearths’ that were indistinguishable from each other (Fruin, 1866, p. 354). It is very difficult to determine how the population of ‘Schipluiden’ developed over time on the basis of these variably aggregated figures. Extending existing coding systems further back in time, such as the ‘Amsterdamse code’ for Dutch historical municipalities (van der Meer & Boonstra, 2011), will not expedite this process. According to coding rules for the ‘Amsterdamse code’, Schipluiden would have the same code of 10130 in all of the above cases except 1514, regardless of the geographical extent of the area in a given year.

To avoid having to solve such complex problems, a common solution is not to present disaggregated figures at all, but to provide aggregated figures for the whole territory. This has two complications. First, there is a significant loss of information. Secondly, often necessary but complicated extrapolations must be introduced to deal with missing values. From our extensive experience working with medieval hearth censuses in the Low Countries as part of the replication study mentioned above, even in a census that appears to cover the entire territory, about 5–10% of the villages are not reported. This may be due to a variety of reasons, sometimes to long-standing privileges of exemption, sometimes to exceptional local circumstances caused by war, famine, or flooding.

Identifying and then dealing with these missing values is context-specific and rather error-prone, while the resulting figures can take on a life of their own – without any mention of the careful considerations that went into their creation. If we compare the actual coverage of a selection of censuses in the County of Holland over time and space, the importance of carefully identifying the missing values (shown in red) – and taking them into account – becomes immediately apparent (see Figure 4). It also shows that it is quite risky to simply take the aggregated total of one census and apply it to a territory as a whole. Although the results have yet to be published,

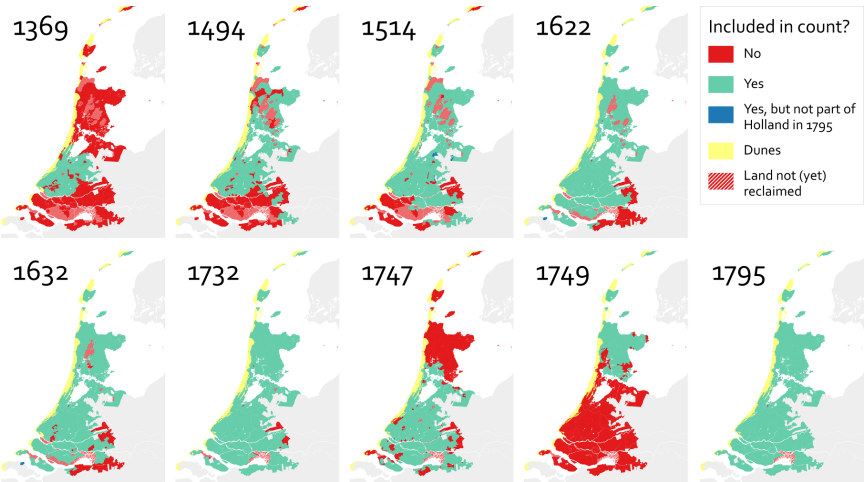


FIGURE 4 Areas of Holland included or missing in several premodern house and population counts, projected onto a map with 1795 boundaries. BURGER VAN SCHOOREL, 1767; CENTRAAL BUREAU VOOR DE STATISTIEK & NIWI-KNAW, 1998; DE BOER 1978; FRUIN 1866, 1876; TIRION 1742, 1744, 1746, 1748, 1750; VAN DILLEN, 1940.

our replication study has already identified numerous examples where this has led to incorrect assumptions about population size in the premodern Netherlands and Belgium. The historical GIS of pre-modern boundaries presented here reduces the risk of such errors, for example by acting as a visual feedback loop to quickly identify missing values.

4 Methods

The historical atlas is based on two types of sources. The first type can be described as existing cartographic material – in the broadest sense. This includes existing GIS files of modern or historic boundaries, but also raster images of historic maps. Where not already available, raster images have been georeferenced for this purpose. A list of the main cartographic sources is given in the Appendix, Table A2. An example of a more detailed list of sources, in this case for the County of Holland, can be found in Stapel (2017).

The starting point is usually one or more base layers, such as modern municipal boundaries or a historical GIS dataset, which are further enhanced using other maps. For the area around Maastricht and Liège, for example, three such base maps were used: modern municipal boundaries (Centraal Bureau voor de Statistiek, 2014), and historical municipal boundaries from both

HISGIS Belgium (Vrielinck et al., 2009), and NLGis (Boonstra, 2009; Zijdemann et al., 2015) (see Figure 5).¹⁶ The late eighteenth-century *Carte de cabinet* by Joseph de Ferraris, that covers the Austrian Netherlands and Prince-Bishopric of Liège and includes all territorial borders, was superimposed on these base maps. Subsequently, all (sections of) local boundaries that coincided with higher-level territorial boundaries on the Ferraris maps were amended (see Figure 6). By repeating this process of supplementing and modifying the base layers using other cartographic sources, such as Beekman's maps (Commissie voor den Geschiedkundigen Atlas van Nederland, 1913–1938) and detailed early modern regional and local maps (see Appendix, Table A2), the first skeleton of a pre-modern GIS dataset of local boundaries is constructed.

The second type of sources is quite different and often much more contemporary to the period that the GIS aims to recreate. To reconstruct the boundaries in a duchy, county, or bishopric for a particular period for which good topographic maps are lacking, we need to know what cities and villages were considered part of that authority and how a territory was subdivided into local administrative units. This is particularly relevant for reconstructing medieval territories in GIS, since maps that record topographically accurate local boundaries do not predate the sixteenth century. Not seldom, such maps are available only from the nineteenth century onwards.

Hearth or house counts (and similar fiscal repartitions) are particularly useful to counter the absence of maps. They are available for almost all parts of the Low Countries, often from the fourteenth or fifteenth centuries onwards (Arnould, 1976). Such censuses not only list cities, villages, and hamlets under the authority's control, the number of hearths can also be used to detect anomalies in the administrative structure of a region. If, for instance, a village has a unusual high density of hearths compared with its surroundings, whereas a neighbouring village is missing from the medieval hearth count altogether, this combined information may indicate that the two villages were originally conjoined in administrative terms – and separated later. A targeted search in scholarly literature can subsequently corroborate or reject this assumption.

The *Historical Atlas of the Low Countries* presented here is the result of linking hundreds of such lists or censuses to the GIS, polishing and refining the maps in each iteration. The resulting fine-grained overview of local administrative structures in the *ancien régime* provides contiguous coverage of the Low Countries and effectively facilitates long-term cross-temporal analysis

¹⁶ The precision of the NLGis maps, originally created in the early 2000s, was improved by using 1832 municipality boundaries available in HISGIS Netherlands (www.hisgis.nl) and digitised topographical maps (www.topotijdreis.nl).

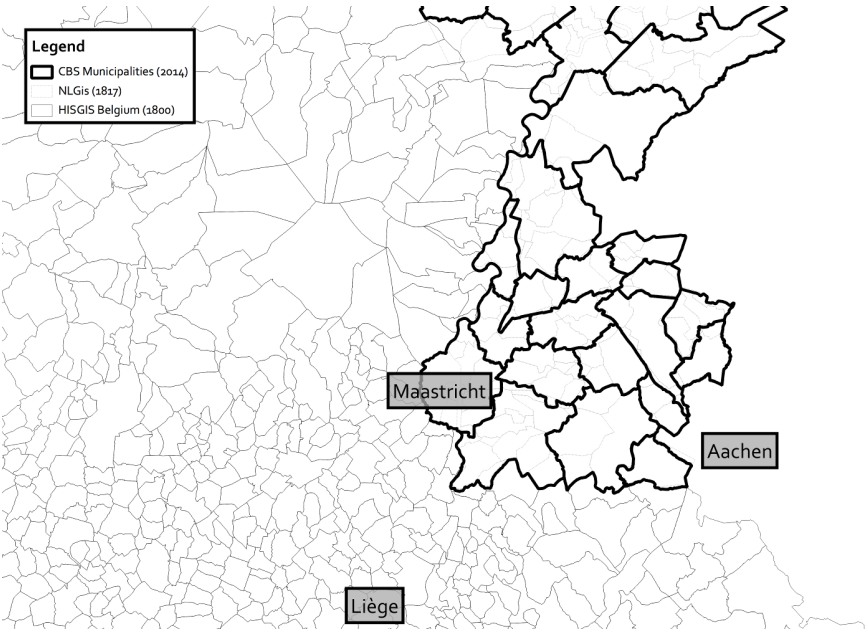


FIGURE 5 Meuse region with GIS base maps

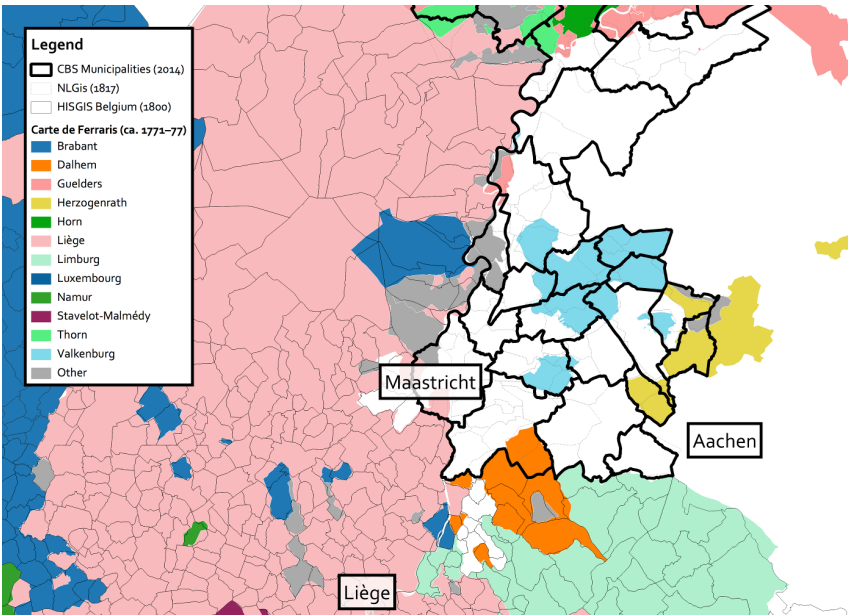


FIGURE 6 Meuse region with GIS base maps, juxtaposed with the boundaries on the Ferraris map

– despite the frequent changes, splits, and mergers of administrative units over the centuries.

5 Description of the Dataset

- **Historical Atlas of the Low Countries (1350–1800)** deposited at IISH Data Collection – Handle:<https://hdl.handle.net/10622/PGFYTMM>
- The *IISH Data Collection* is the CoreTrustSeal-certified repository of the International Institute of Social History.
- **Temporal coverage:** 1350–circa 1840

The dataset is designed as a set of interacting GIS layers (see Figure 7). The main information is stored in a point-based gazetteer layer that covers all temporal cross-sections. The attributes of this point layer are time-stamped. Alternative, time-dependent features can be assigned to a locality in the future (currently, attributes are only available for the year 1500). The dataset also consists of polygon layers of local boundaries, one for each cross-section. The polygon layers are essential for area-specific calculations and for visualisation purposes. In essence, however, the polygons should be interpreted as characteristics of the centroids: they represent the (proposed) outer limits of the administrative units defined in the gazetteer layer. Each polygon contains at least one point, but because it is not always possible to approximate the geographical extent of a historical unit, not every point has to have its own polygon. This means that several centre points can be placed within the boundaries of a polygon. The point and boundary layers are supplemented by four landscape layers,

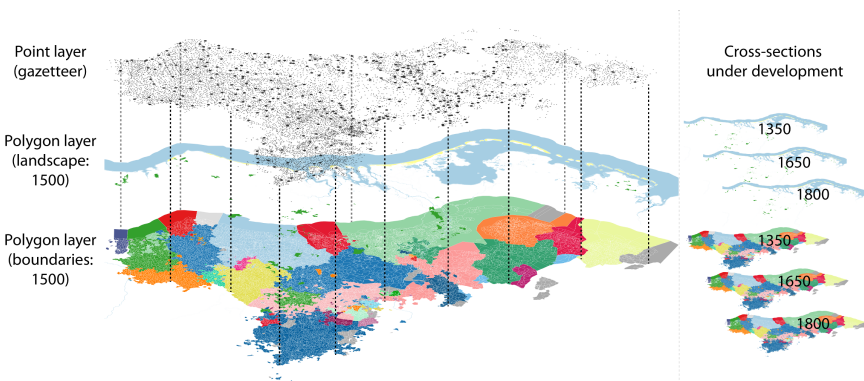


FIGURE 7 Schematic overview of the different GIS layers in the Historical Atlas of the Low Countries

again one for each cross-section. These landscape layers contain some basic characteristics of the underlying landscape and are used for both visualisation and analysis purposes.

In a small number of cases, it was not possible to locate, even approximately, the localities mentioned in sources.¹⁷ However, as it may still be important to take these localities into account, for example when aggregating figures, a hexagonal grid has been created in the North Sea to accommodate such localities. This ensures that unidentifiable localities are also visualised.

The unit of analysis chosen for the GIS dataset is the smallest mappable unit that is referenced as an administrative aggregation by sources from the period covered by the dataset, 1350 to 1800.¹⁸ Whether or not a particular area is explicitly mentioned in contemporary historical sources is the main criterion for whether to map it. In most cases these areas correspond to (localities within) parishes, administrative-judicial areas (lordships, towns), or combinations of these. What exactly constitutes these smallest mappable units varies between and sometimes within, territories. The dataset is therefore not a map that covers all parishes or all lordships in the Low Countries, although for many areas this information can be easily extracted using variables associated with the units. The smallest mappable units form a collection of ‘pseudo-territories,’ which have no formal territorial meaning of their own, but which function as geospatial building blocks for cross-temporal analysis (for similar use of pseudo-territories, see Gay (2021) and Litvine et al., [2020]).¹⁹

The main components and variables of the dataset are as follows:²⁰

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- 17 Examples include an exclave of the Duchy of Limburg, ‘Puyseur’, in 1469 said to be located near Namur, some eighty kilometres west of Limburg itself (Brussels, ARA, CC, no. 45807, fol. 7r; Pauquet, 1968, pp. 13–14;) and the Hof Putzfeld or Pinsfeld, part of the lordship Beaufort in the Duchy of Luxembourg (Wynants, 1983, p. 19).
 - 18 Although this is debatable, we do not consider parcels to function in an administrative sense in the same way as municipalities, lordships, parishes, census tracts, etcetera do. Therefore, parcels are not normally mapped in the dataset (although groups of parcels may be, depending on their historical context).
 - 19 To illustrate the lack of real territorial meaning of the ‘smallest mappable units’, consider the following example: the town of Aardenburg in Zeeland is divided into two municipalities and two jurisdictions that do not correspond to the municipal boundaries: the town of Aardenburg and the lordship of Middelburg. A distinction is also made between intramural and extramural areas. The smallest mappable units in our dataset form a set of intersecting geometries, such as ‘Aardenburg: extramural, parish of Saint Bavo, lordship of Middelburg’. Such a combination of intersecting religious and secular territories has no historical meaning in itself but allows users to link and compare parish records in one year with intramural population counts in another.
 - 20 A more detailed codebook is available with the dataset: <https://hdl.handle.net/10622/PGFYTm>.

- *Names and name variants*: each unit has a preferred name which usually following modern spelling conventions, a name extension (if relevant), a disambiguation statement (if relevant), and an infinite number of name variants. A name extension, that is not part of the toponym, may refer to relevant information to distinguish different areas: ‘Leiden (Parish St. Peter)’ is an example.
- *Identifier*: each unit has a unique identifier. This identifier consists of at least six characters: two letters corresponding to a sovereign territory and four unique digits. In many cases, the sequence of these four digits follows conventional subdivisions of the territory (e.g., bailiwicks), but essentially neither the two letters nor the following digits have any meaning of their own. The first two letters serve only as an indicator, which does not change even if the area changes hands or sovereignty is disputed. More precise and time-stamped information about the territory or territories to which the unit belonged to can be stored elsewhere.

The identifier can be further subdivided by adding a letter, and, if necessary, followed further by a number (see Figure 8). In theory, this process can be repeated by alternating letters and numbers. A reference to “HO1355” should be understood as the aggregation of all ranges beginning with “HO1355”. “HO1355D” would refer to the combined areas “HO1355D1” to “HO1355D9”. This design provides a flexible way of dealing with recurring historical mergers and splits of administrative areas in future releases of the dataset, while maintaining backward compatibility with statistics already linked (Stapel, 2023).

The identifiers are stored in the point layer. The identifiers of the polygon layer consist of all the point identifiers within a given polygon geometry, separated by semi-colons and arranged alphabetically. In order to link different units that form one parish, the dataset includes a variable for a unique parish identifier. The parish identifier refers to the unique identifier of the area in which the parish church is located.

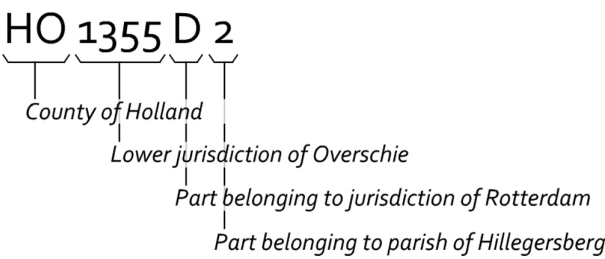


FIGURE 8 Example of the hierarchical composition of the unique identifiers

Localities that have been submerged and re-established after reclamation (sometimes under a different name) present a particular challenge. Rather than treating these as separate entities, which is generally preferable, we have chosen to apply the same identifiers to both localities to avoid potential problems when applying cross-temporal analyses to the area.

- *Corresponding identifiers*: each unit may be associated in some way with identifiers used in a number of different datasets. These may include references to modern gazetteers such as GeoNames or wikidata, Wikipedia references, modern Dutch, Belgian, German, French, and Luxembourg municipal codes. Some are only available for the polygon layer, others for both point and polygon. The mappings make the dataset easier to find and use, and will facilitate future integration of this dataset into (historical) gazetteers. The completion of these correspondences and the integration of the *Historical Atlas of the Low Countries* into the World Historical Gazetteer are high on the agenda for future releases (see Section 7, with Concluding Remarks).
- *Administrative relations*: a local area usually belongs to several larger territorial or administrative units. Two types of relationships are predefined: the Catholic hierarchy ranging from archbishoprics to deaneries and the higher, middle, and lesser jurisdictions: the hierarchical judicial system attested throughout the Low Countries, with higher justice including capital punishment. Of the ‘open’ administrative variables, two are reserved. One for the highest level of sovereignty (England, France, or the Holy Roman Empire), the other for the main territory (e.g., County of Holland, Prince-Bishopric of Liège). Subsequent administrative hierarchies (e.g., quarters, castellanies, bailiwicks, etc.) differ from territory to territory and should be defined in the Codebook. There may be up to ten levels of administrative relationships, which need not to be hierarchical. Disputed or unclear administrative relationships and condominiums may be indicated by a semicolon as a separator.
- *Urban status*: this refers to localities, whatever their size, with formal town privileges. In all cases, the area within the city walls, the urban enceinte or *intra muros*, is distinguished from the area outside the walls or *extra muros*. This distinction often appears in contemporary, premodern sources such as hearth counts and allows users to compare the sizes of urban enceintes across the Low Countries and ultimately across time (for such uses: Buringh, 2021; van Druenen, 2022). Where no city walls (or equivalent features) were erected, the built-up area of a town at a given time was estimated. In such cases, this is clearly indicated in the dataset. A special indicator is reserved for rural-like localities that nevertheless received some kind of urban charter. Such examples can be found in West-Friesland, Brabant, and Luxembourg.

- *Landscape status*: a separate landscape layer is used to distinguish cultivable or habitable land from landscapes that usually have few or no inhabitants at the time. Such landscapes include water, mudflats, dunes, and extensive forests. By making this distinction, more meaningful density calculations can be made. For example, if the dune areas in Holland were not isolated, population densities in the coastal communities would be unrealistically low. While the landscape information is stored in a separate GIS layer, each geometry in the polygon or boundary layer provides calculated surface area values for each landscape type.
- *Timestamp*: each unit has a timestamp that indicates when a particular polygon or locality (or its attributes) is relevant. In this first tranche, which focuses on a single cross-section, all units have a timestamp between 1 January and 31 December 1500. Further application and refinement of these timestamps may be extended in the future.
- *Type, quality, precision, and sources*: each unit of analysis contains information on the type of unit, how the area and/or location was determined, the level of precision, and the sources used. Type attributes are used to categorise the geometries. For example, localities that do not yet exist in 1500 (e.g., Charleroi in Belgium) but are included to facilitate cross-temporal analysis are marked accordingly. Precision indicators are used to indicate how close a point is to the natural centre point of a locality (e.g., a parish church). They may also indicate that a point is randomly placed within the boundaries of the associated polygon geometry.

Quality indicators are used to determine the type of information on which the polygon boundaries are based. These range from modern administrative boundaries to (near-)contemporary sources or estimates based on natural features or historical cadastral sections. Typically, especially for the 1500 cross-section, boundary reconstructions are based on non-contemporary sources (such as nineteenth-century municipal boundaries). Source references are stored with each spatial unit. At present, source and quality attributes are associated with the entire polygon rather than with specific boundary segments, as would be preferable. This can be resolved by converting the polygon layer to a more formal topological (linear boundary-based) GIS, which we plan to do in future releases of the dataset.

6 Using the Dataset in Spatiotemporal Analysis

The dataset is set up in such a way that, in principle, any historical observation between the fourteenth and nineteenth centuries can be linked to the dataset,

regardless of the temporal cross-section available. For visualisation purposes (or surface area calculations) it may be necessary to select an appropriate cross-section, but this is not necessary for longitudinal analysis: observations are linked directly to the point geometry or gazetteer layer, whose unique identifiers remain unchanged over time (see Figure 9).

It is less straightforward to decide to which pseudo-territory or group of pseudo-territories a particular observation in your historical data should be linked. This is highly context- and time-specific, as the examples of Schipluiden and Amsterdam above have shown. Making these decisions is a thorough scholarly exercise and it is advisable to approach this process with caution. In our experience, the best practice consists of two parts. First, use the contextual information in the GIS dataset to your advantage: if your data is about parishes, use the `PARISH_ID` variable to identify all the pseudo-territories that are associated with a particular parish. If the data concerns lordships, the `LOW_JURISD` variable is likely to be useful. Creating a subset of the map based on a particular territory or administrative region (`ADMO` to `ADM9`) may also be helpful.

Secondly, it is advisable to be cautious in the first round of linking data to the maps and only link obvious observations. In a second round of linking, missing observations and unlinked pseudo-territories that you are left with provide a starting point for a more thorough decision-making process. Deciding whether an area has been deliberately omitted from a dataset of historical statistics, or whether that area is silently included in the statistics of a neighbouring village is one of the most crucial steps in linking statistics to the correct historical areas. To see how this works in practice, see Figure 3.

However, ways are being found to make this process easier. First, the Digital Infrastructure Department of the KNAW Humanities Cluster has developed a plugin for QGIS – open-source GIS software – to streamline the linking process, which is currently in a beta testing phase. Secondly, as each collection of historical statistics is linked to the *Historical Atlas of the Low Countries*, more knowledge about the geographical extent associated with historical observations of localities or administrative areas becomes available. Such knowledge can potentially be reused to support future linking processes: feedback that an observation ‘Amsterdam’ in an earlier processed source from 1470 included area X, Y, and Z, and X and Y in 1780, could help and speed up the decision on which areas to select for a third source from 1750. This is a possibility we are currently exploring further.

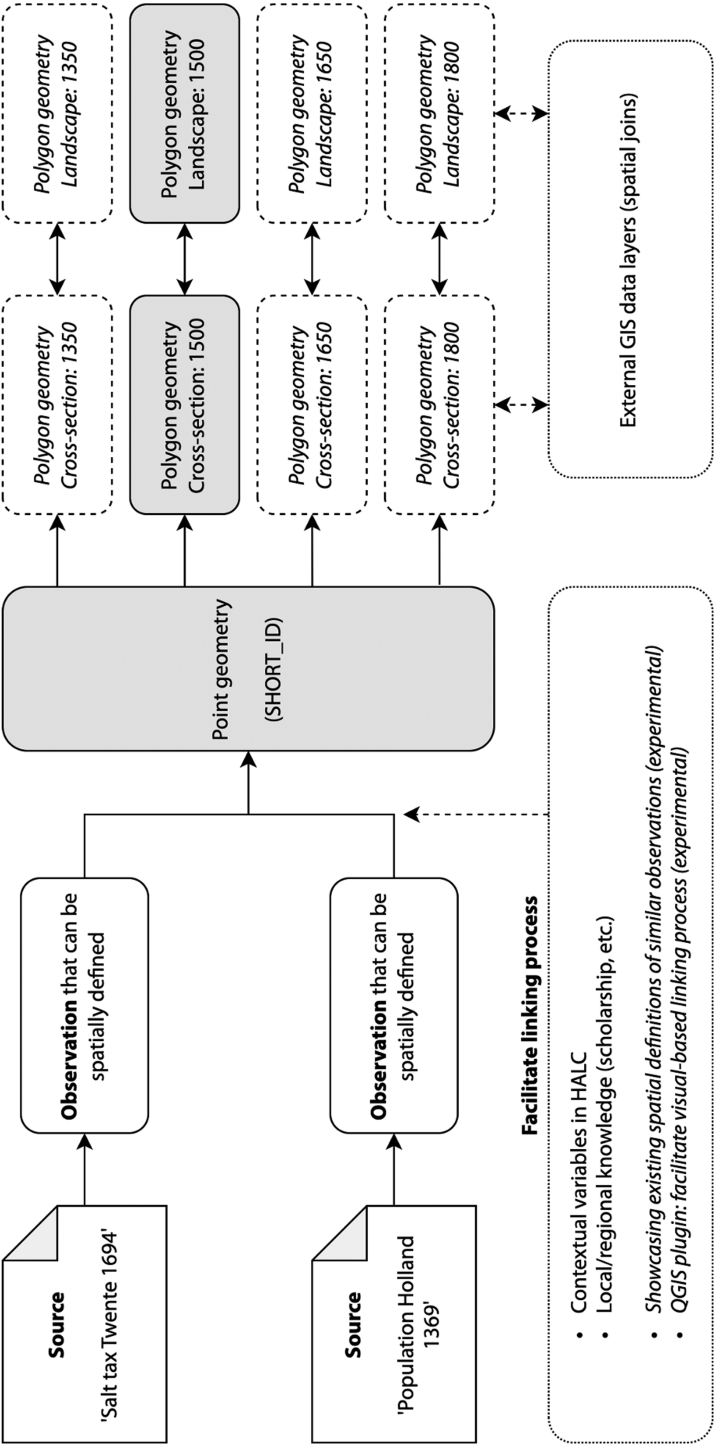


FIGURE 9 Flowchart showcasing the process of linking sources to the GIS layers

7 Concluding Remarks

There are, of course, some outstanding issues – not just those relating to the completion of the three remaining cross-sections (see Appendix, Table A1). As the project grows and new users will actively engage with the data, it will become increasingly important to establish a robust tool for dealing with the inevitable errors discovered by the user community, requests for changes and additions, and authoritative rulings on the use of the unique identifiers. Another issue that we want to work on is to ensure that the GIS atlas is consistent with the recently updated palaeogeographic maps of the Netherlands (Vos & De Vries, 2013).

To ensure that our data is accessible and used by as many interested parties as possible, it is necessary to improve the interoperability of the place name data (which is limited at this stage of completion). In particular, we intend to link and integrate the dataset with the World Historical Gazetteer (WHG). The WHG is a project led by the University of Pittsburgh that provides a central repository for digital historical place name data from around the world.²¹ The GIS data itself is stored in the CoreTrustSeal-certified Dataverse repository of the International Institute of Social History, the *IISH Data Collection*.²² In terms of academic content and the creation of new releases, the embedding of the project is institutionally secured at the IISH for the immediate foreseeable future.

Ultimately, the *Historical Atlas of the Low Countries (1350–1800)* has the potential to be of enormous value to researchers and non-academic audiences in the Netherlands, Belgium, and beyond. Instead of relying on imprecise definitions of regions, it becomes possible to study historical phenomena in their detailed spatial and geographical context. It will also be possible to make valid and consistent comparisons over time, something that is currently a major deficiency in quantitatively based humanities research. This infrastructure will, in turn, allow researchers to actively bridge the gap between broad macro-level historical developments and real-life micro-level changes that can be so difficult to overcome.

²¹ www.whgazetteer.org. Before we can link the place names in the *HALC* database to the World Historical Gazetteer, a number of technical issues need to be addressed. These concern a strategy for how best to link place name data from a living project, which is constantly being updated, to the WHG.

²² <https://datasets.iisg.amsterdam>. Direct access to the *HALC* dataset is found here: <https://hdl.handle.net/10622/PGFYTM>.

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Appendix

TABLE A1 Publication schedule of open-access versions of the Historical Atlas of the Low Countries dataset

Version	Date completed or expected	Number of spatial units	Cross- section	New territories
6	September 2019	3.500	1500	Brabant, Hainaut, Holland, Liège, Mechelen
7	September 2020	4.700	1500	Artois, Cambrai, Ravenstein, Thérouanne, Vianen, Zeeland
8	2023	16.000	1500	Bentheim, Boulogne, Bouillon, Buren, Cleves, Culemborg, Dalhem, Drenthe, East Frisia, Eu, Flanders, Frisia, Guelders, Groningen, Herzogenrath, Horn, Limbourg, Lingen, Luxembourg, Namur, Overijssel, Picardy (Amienois, Ponthieu, Vermandois), Prüm, Saint- Hubert, Stavelot-Malmédy, Thorn, Tournai, Utrecht, Valkenburg
[X]	2024–2025	1.000	1350	Holland
		2.000	1500	Adjacent areas in Rhineland and Westphalia (e.g. Cologne, Jülich, Moers, Münster)
		1.000	1650	Holland
		18.000/ all	1800	<i>All territories</i>
[Z]	2025–2026	18.000/ all	1350	<i>All territories</i>
		18.000/ all	1650	<i>All territories</i>

TABLE A2 Base maps used for the reconstruction (M = Modern, H = Historical)

Country	Available base maps	Source/ Website	Type	Characteristics	Quality and usability
[General]	OpenStreetMap	www.openstreetmap.org	GIS; WMS	M	Local administrative boundaries, sometimes below municipal level
	Jacob van Deventer	Various archive locations (compare: Rutte et al., 2018) www.cultureelerfgoed.nl /onderwerpen/bronnen-en-kaarten/overzicht /kaart-van-de-verstedelijking	Raster	H	Town atlas of the Low Countries, ca. 1545–75
					Useful for determining extent of medieval and early-modern walled cities
Netherlands	Gemeentegrenzen	www.cbs.nl	GIS	M	Municipal boundaries
	NLGis	www.nlgis.nl www.gemeentegeschiedenis.nl https://easy.dans.knaw.nl	GIS	H	Due to high degree of merging, the modern municipal boundaries are often insufficient for historical reconstructions Less accurate on local scale

TABLE A2 Base maps used for the reconstruction (M = Modern, H = Historical) (*cont.*)

Country	Available base maps	Source/ Website	Type	Characteristics	Quality and usability
	HISGIS Nederland	www.hisgis.nl	GIS	H	Cadastral parcels, ca. 1832 Available for certain areas of the Netherlands
	TopoTijdReis	www.topotijdreis.nl	Raster; WMS	M/H	Georeferenced topographic maps 1815–2015 Displays municipal boundaries from ca. 1870 onwards
	Geschiedkundige Atlas	(Beekman, 1913) (Muller Fz. & Beekman, 1921)	Raster	H	Thematic historical maps and descriptions Less accurate on local scale. Most relevant are the parish boundaries (ca. 1550) and judicial boundaries (1795)
	Historical maps; cadastral maps	www.archieven.nl www.nationaalarchief.nl https://beeldbank.cultureelerfgoed.nl And further regional archives. For a non-exhaustive list of referenced maps: Stapel (2017)	Raster	H	Various historical and cadastral maps, 16th-19th century

TABLE A2 Base maps used for the reconstruction (M = Modern, H = Historical) (*cont.*)

Country	Available base maps	Source/ Website	Type	Characteristics	Quality and usability
Belgium	HISGIS België/ LOKSTAT	www.hisgis.be [currently unavailable]	GIS	Municipal boundaries, 1800–2002	
	Cartes de Vandermaelen	www.queteletcenter.ugent.be https://geoportail.wallonie.be www.geopunt.be	Raster; WMS	Georeferenced topo- graphic maps, 1846–54	Displays municipal bounda- ries from ca. 1850
	Historical maps; cadastral maps	www.cartesius.be	Raster	Various historical and cadastral maps, 16th–19th century	
	Ferraris Map	https://geoportail.wallonie.be www.geoportail.lu www.geopunt.be www.mapire.eu www.kbr.be/nl /kaart-van-ferraris	Raster; WMS	Georeferenced maps of the Austrian Netherlands and Prince-Bishopric of Liège, ca. 1771–78	Boundaries between the territories only
Luxembourg	Communes et Sections Cadastrales	https://data.public.lu	GIS	Municipal boundaries	
	Historical cadastral maps	https://data.public.lu www.geoportail.lu	Raster	Cadastral maps, ca. 1830–34	

TABLE A2 Base maps used for the reconstruction (M = Modern, H = Historical) (cont.)

Country	Available base maps	Source/ Website	Type	Characteristics	Quality and usability
France	Topographic Maps	www.geoportail.lu	Raster; WMS	Georeferenced topo- graphic maps, 1907–2000	Since few municipalities have merged or split, the modern municipal bound- aries are a good starting point for historical reconstructions No boundaries
	Contours des communes	https://data.gouv.fr	GIS	Municipal boundaries	
Germany	Carte de Cassini	https://geoportail.gouv.fr	Raster; WMS	Georeferenced maps, 1748–56	Includes municipal boundaries
	Carte de l'État-Major	https://geoportail.gouv.fr	Raster; WMS	Georeferenced topo- graphic maps 1820–66	
	Geschichtlicher Atlas der Rheinlande	(Irsigler et al., 1982–2008)	Raster	Thematic historical maps and descriptions	

TABLE A2 Base maps used for the reconstruction (M = Modern, H = Historical) (cont.)

Country	Available base maps	Source/ Website	Type	Characteristics	Quality and usability
	Verwaltungsgebiete	www.geodatenzentrum.de	GIS	M	Due to high degree of merging, the modern municipal boundaries are often insufficient for historical reconstructions
	Preußische Neuaufnahme	www.deutschefotothek.de www.geoportal.nrw https://geoportal.rlp.de https://geoportal.saarland.de www.geobasis.niedersachsen.de www.mapire.eu	Raster; WMS	H	Includes municipal boundaries
	Tranchot-Von Müffling Map	www.geoportal.nrw https://geoportal.rlp.de https://geoportal.saarland.de	Raster; WMS	H	Georeferenced maps of the Meuse-Rhine region, 1801–28